

## **TITLE**

### **MOUNTING STRUCTURE FOR MOTOR CONTROLLER OF HEAT- DISSIPATING DEVICE**

#### **BACKGROUND OF THE INVENTION**

##### **Field of the Invention**

The present invention relates to a seat for a motor controller of a heat-dissipating device, and in particular to a motor controller and a seat for a DC brushless motor in a heat-dissipating device.

##### **Description of the Related Art**

DC brushless motors are used in many electronic devices, such as heat-dissipating fans. Fig. 1A shows a conventional fan using a DC brushless motor. In Fig. 1A, the fan includes a frame 11, a printed circuit board 12 (PCB), a stator 13, and a rotor 14. When assembling the fan, the PCB 12, stator 13 and rotor 14 are sequentially assembled to a sleeve 111 on a base portion of the frame 11.

Unlike a conventional DC motor, a brushless DC motor includes a Hall sensor to detect the phase change of magnetic field and a driving circuit to convert current direction in the stator winding, rather than the brushes used in the conventional DC motor. The converted current in the stator winding induces a magnetic field to drive the rotor. The Hall sensor in the conventional DC brushless motor is generally disposed on a PCB. In Fig. 1A, the pins of the Hall sensor 15 are surface-mounted on the relative contacts on the bottom surface 121 of the

PCB 12, and the Hall sensor 15 is then bent upward, extending into the stator 13.

Fig. 1B shows another structure to fix a Hall sensor on a PCB of the conventional DC brushless motor. In Fig. 1B, a plurality of holes 16 are formed on the PCB 12. The pins 151 of the Hall sensor 12 pass through the holes 15 and are soldered to the bottom surface of the PCB 12.

The circuit of the above conventional mounting methods for Hall sensors is, however, complicated, which reduces available layout area on the PCB and increases fabricating cost. The complicated layout on the PCB also increases impedance and causes considerable power loss. Moreover, since the Hall sensors are not consistently bent to predetermined angles during fabrication, their position corresponding to the position of the magnetic poles will be easily displaced resulting from externally careless collision.

Hence, there is a need for a better DC brushless motor with lower cost, precise angling of a Hall sensor and precise speed control.

#### **SUMMARY OF THE INVENTION**

Accordingly, an object of the invention is to provide an integrated motor controller for a DC brushless motor. The integrated motor controller controls and drives the DC brushless motor to replace the conventional complicated PCB.

Another object of the invention is to provide an improved mounting structure for the above integrated

motor controller, reducing cost and fabrication complexity, whereby the fan can be precisely controlled.

5 The present invention provides a modified structure of a heat-dissipating device with a seat to secure the motor controller thereof. The seat is fixed on a base of the heat-dissipating device and includes a slot to hold the motor controller.

10 The seat of the present invention is a substantially square seat. The slot is shaped according to the profile of the motor controller and formed in the central portion of the seat. The seat has at least one hook to fix the seat on the base of the heat-dissipating device.

15 In a preferred embodiment, the seat is formed by a plurality of positioning pillars. The positioning pillars have U-shaped cross sections respectively and are separated according to the profile of the motor controller.

The seat is mounted on, adhered to, or integrally formed on the base.

20 The present invention also provides a heat-dissipating device including a frame with a base, a stator disposed on the base and a rotor surrounding the stator coupling thereof. A seat is fixed on the base and has a slot securing the motor controller to drive and control the heat-dissipating device.

25 The motor controller has a plurality of pins with broadened contacts to which a plurality of wires of an external device are connected. Furthermore, the motor controller is an integrated circuit, controlling the

heat-dissipating device and detecting phase change of the magnetic field around the stator.

The present invention provides another heat-dissipating device including a frame with a base, a stator disposed on the base and a rotor surrounding the stator coupling thereof. A seat is fixed on the stator and has a slot securing the motor controller.

A detailed description is given in the following embodiments with reference to the accompanying drawings.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

The present invention can be more fully understood by reading the subsequent detailed description and examples with references made to the accompanying drawings, wherein:

Fig. 1A is an exploded view of a conventional fan using a DC brushless motor;

Fig. 1B is an exploded view of another way for fixing a Hall sensor on a PCB in a conventional DC brushless motor;

Fig. 2 shows a mounting structure for the motor controller of a DC brushless motor in a first embodiment of the invention;

Fig. 3 shows a mounting structure for the motor controller of a DC brushless motor in a second embodiment of the invention;

Fig. 4 shows a mounting structure for the motor controller of a DC brushless motor in a third embodiment of the invention; and

Fig. 5 is a schematic view of the broadened contacts of the motor controller.

#### DETAILED DESCRIPTION OF THE INVENTION

The present invention provides a modified structure of a heat-dissipating fan with a seat for a motor controller thereof. The heat-dissipating fan has an integrated motor controller, such as an integrated circuit (IC) combining motor driving circuits and a Hall sensor to detect the phase change of magnetic poles and drive the motor thereof. The integrated motor controller can also control the motor according to the detected phase change through a pre-set control application.

Fig. 2 shows a mounting structure for the motor controller of a DC brushless motor in a first embodiment of the invention.. In Fig. 2, the seat 22 is substantially square with a slot 221 in the central portion thereof. The slot 221 can be shaped according to the profile and size of the motor controller 23 to contain the motor controller 23 therein. The seat 22 has two hooks 222 on the either side of the bottom surface to engage holes 211 on the base 21, so as to fix the seat 22 thereon. Alternatively, the seat 22 can also be adhered to the base 21.

After the stator 24 is assembled on the sleeve 212 of the base 21, the relative position of the stator 24 and the motor controller 23 contained in the seat 22 can be determined. Thus, through such a mounting design, the relative position between the motor controller 22 and the

stator 24 will not be shifted due to the collision from an external force.

Fig. 3 shows another mounting structure for the motor controller of a DC brushless motor according the present invention. In Fig. 3, the seat 32 is formed by a pair of positioning pillars 321 respectively having U-shaped cross sections, separated according to the profile of the motor controller 33, allowing the motor controller 33 to be assembled therebetween. The positioning pillars 321 can be mounted on, adhered to, or integrally formed on the base 31. Similar to the structure shown in Fig. 2, the relative positioning between the stator 34 and the motor controller 33 contained in the seat 32 can be determined after the stator 34 is telescoped to the sleeve 312 of the base 31.

Another mounting structure for the motor controller is provided in Fig. 4. The stator 44 includes two cover portions 441 and a plurality of stator plates sandwiched therebetween. The seat 42 for the motor controller 43 of the third embodiment can be disposed on a cover portion 441 of the stator 44. Furthermore, the seat of this structure includes two positioning pillars 42 similar to those in Fig. 3, disposed on the lower cover portion 441 between two neighboring magnetic poles, allowing assembly of motor controller 43 therebetween. Finally, the rotor 45 and stator 44 are sequentially telescoped to the sleeve 412 of the base 41. Thus, the motor controller 43 can detect phase change of the magnetic field and control the motor of the fan.

The method of connecting the pins of the motor controller and the wires is shown in Fig. 5. The pins 531 of the motor controller 53 can be designed with broadened ends, forming contacts 532 with larger soldering area for the wires 533. Thus, the wires 533 of an external system can be firmly soldered to the contacts 532, forming electrical connections.

Compared to Hall sensors mounting on conventional PCBs, the positions of the motor controller secured in the seat and the stator in the invention are precise, preventing additional bending steps, failures during the bending step and eliminating the position shifting between the magnetic poles and the Hall sensors.

Furthermore, the layout area and the number of the elements on the conventional PCB are limited. The complicated layout on the conventional PCB also increases impedance and causes considerable power loss. Moreover, according to the aspect of the present invention, the driving circuit and Hall sensor are integrated as a motor controller (i.e. integrated circuit) utilizing the software to drive and control the rotation of the motor. Thus, a fan with the integrated motor controller of the invention can reduce the number of elements and manufacturing cost and time without needing PCB, lower impedance and increase efficiency of heat-dissipation.

While the invention has been described by way of example and in terms of the preferred embodiments, it is to be understood that the invention is not limited to the disclosed embodiments. To the contrary, it is intended to cover various modifications and similar arrangements

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(as would be apparent to those skilled in the art).  
Therefore, the scope of the appended claims should be  
accorded the broadest interpretation so as to encompass  
all such modifications and similar arrangements.